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HUMAN OCCUPATIONAL ILLNESS PROBLEMS DUE TO ETHYL PARATHION EXPOSURE IN CALIFORNIA IN 1975

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Ethyl parathion is one of the oldest and most widely used organophosphate pesticides. It's very high mammalian toxicity limits its usefulness. In the 5-year period, 1970 through 1975, there were 351 occupational exposures to parathion reported by physicians in California. Sixty-eight of these exposures occurred in 1975. There were 912,000 pounds of ethyl parathion applied to California crops that year.

MATERIALS AND METHODS

California is the only state that has a compulsary occupational injury reporting system. In addition to the medical reports submitted on the symptoms, diagnosis and medical care provided, many of the pesticide incidents receive follow-up field investigations; this is particularly true of the more serious poisonings. The organophosphates in general and ethyl parathion and mevinphos (Phosdrin) in particular are responsible for most of the serious poisonings. The 68 medical reports received from physicians in 1975 and the follow-up investigations that implicated ethyl parathion as the probable cause of the illnesses were studied. Data on these cases is summarized.

RESULTS

Field Worker Multiple Poisoning

In the only incident that involved multiple exposure, 17 field workers slept at night in a grove that had been previously treated with ethyl parathion and was posted with warning signs to stay out for 21 days. Along with three others, these 17 workers also entered two fields in advance of the expiration of the 21-day safety interval. One field was reentered 1 day early, the other was reentered 5 days too early. Sixteen workers eventually developed symptoms typical of organophosphate poisoning, 3 of which were hospitalized overnight. Plasma cholinesterase values for 19 of these 20 workers were below the lower end of the normal range.

This particular incident involved six different violations of California's pesticide regulations. Legal action was taken against the grower because of: too early reentry, one field, one day; too early reentry, one field, five days; failure to make prior arrangements for medical care; failure to take ill employees to a physician; failure to post warning signs in an appropriate foreign language; and making false records.

Individual Cases

A ground applicator became ill after wind blew parathion spray in his face. He experience weakness, salivation, and nausea. Although he was wearing all the required protective clothing, the employee did not discontinue spraying even though the wind was continuing to blow parathion in his direction. He was treated and lost work time because of parathion poisoning.

An employee started feeling nauseous after loading and applying parathion. Although not hospitalized, he missed work due to this exposure.

A ranch foreman, making minor repairs to a spray rig that had been used to spray parathion, was treated for parathion poisoning and missed work.

An employee was sent to the hospital after becoming nauseated when spraying with parathion. All the required safety equipment had not been issued or worn although the employer and employee knew they were required.

A ground applicator developed parathion poisoning after spraying with parathion for about 4 hr 1 day. The employee used all required safety equipment and avoided drift. He had worked with this pesticide for 41 hr in the previous 30 days, so this could have been a case of chronic poisoning.

A ground applicator experienced parathion poisoning and missed work after spraying parathion without a respirator, even though all protective clothing was available.

An employee mixing and loading parathion experienced nausea and vomiting, developed organophosphate poisoning, and was hospitalized for 3 days. All safety equipment was provided, but it may not have been properly used.

An aerial applicator experienced a severe headache, vertigo, and extreme weakness after apparently flying through drift from his own plane while round-robining with a partner. This was diagnosed and treated as parathion poisoning.

A field worker walked through an orange grove that had been treated with parathion

a few hours earlier. He experienced nausea and vomiting for 2 days and was diagnosed and treated for parathion poisoning. The employee said he did not notice signs telling of the danger of entering the grove.

A farm mechanic started vomiting and developed parathion poisoning after doing some metal cutting with a torch on a sprayer that had residual parathion on it. He had not been working in a well-ventilated area nor had he been informed of the possible danger involved.

A ground applicator developed a headache and became nauseous after spraying with parathion. He had been provided with and used all safety equipment, but developed parathion poisoning in spite of this.

A mixer/loader had been working for about 3 hr with parathion when he became nauseated and weak and had to be hospitalized for 2 days for parathion poisoning.

A ground applicator spilled some parathion on his hands and failed to wash immediately. He experience nausea, began vomiting, and was hospitalized for 2 days for parathion poisoning.

An employee was bagging parathion at a chemical plant. He experienced labored breathing and heavy perspiration, was hospitalized in an intensive care ward for 1 day and received follow-up treatment for parathion poisoning.

A laborer in a manufacturing plant was cleaning out material that had been utilized the previous day to formulate wettable parathion. He experienced muscular tremors and was hospitalized for 3 days for parathion poisoning. Although he had been wearing all the recommended safety equipment at the time, the plant was extremely hot. There is also a possibility that he ingested some parathion by contaminating his noon meal with incompletely washed hands.

A mixer/loader became nauseated and vomited after he smoked some cigarettes and ate his lunch while sitting on top of a machine tank that he was using to mix parathion. He was hospitalized for 2 days. He had been issued all the recommended protective equipment and he had been trained in its proper use.

A worker moving nearly empty parathion drums had some parathion spill on his skin. He suffered from nausea and fatigue and was hospitalized for 1 week, missing a total of 2 weeks work as a result of parathion poisoning.

A ground applicator was spraying parathion. He became ill and experienced headache and nausea which was diagnosed and treated as organophosphate poisoning.

A cleanup man in a formulating plant spilled parathion on his face and also allowed the chemical to get on his arm through the glove gauntlet that he was wearing. A few hours later, he began feeling weak and started vomiting. This case was diagnosed and treated as parathion poisoning.

A mixer/loader picked some oranges with contaminated gloves he had just previously used to mix parathion. He then pulled off the gloves, peeled the oranges and ate them without washing his hands. He developed what was diagnosed as parathion poisoning.

A worker, wearing all the recommended safety equipment and helping to fill a spray tank with parathion, started to feel weak after about 4 hr. He was subsequently hospitalized for about a week with what was diagnosed as parathion poisoning.

Disability periods for the 1975 exposures to parathion are provided in Table 1.

TABLE 1 - PERIODS OF DISABILITY FROM OCCUPATIONAL EXPOSURE TO PARATHION IN CALIFORNIA IN 1975

Hospitalized, 17 Workers

- 1 worker for 1 day.
- 1 worker for 2 days and subsequently missed 2 weeks work.
- 3 workers for 2 days (1 worker also missed 30 days work).
- 2 workers for 3 days.
- 1 worker for 3 days and subsequently missed 20 days work.
- 1 worker for 4 days and subsequently missed 7 days work.
- 1 worker 5 days.
- 1 worker for 7 days and to miss 14 days work.
- 1 worker in intensive care for 1 day, total stay indefinite.
- 1 worker for greater than 5 days.
- 4 workers for an indefinite period of time.

Although all the reports did not state how long the employee was out of work, all workers listed missed at least 7 days of work in addition to their hospitalization. It was also assumed that if some type of work was resumed, it did not involve exposure to organophosphates or carbamates for at least 30 days beyond the onset of illness in order to allow the cholinesterase enzyme levels to return to legal levels.

111 But Not Hospitalized, 51 Workers

- 5 workers missed 1-3 days work.
- 4 workers missed 2 days work.
- 1 worker missed 4 days work.
- 3 workers missed 7 days work.
- 13 workers missed work but reports did not state how long.
- 20 workers did not miss any work.
- 5 reports did not give adequate information.

DISCUSSION

Ethyl parathion continues to cause human illnesses in numbers of persons exposed as users and field workers far out of proportion to its usage as compared to other pesticides. It was one of the first organophosphate pesticides registered and it has

only a small safety factor between its killing potential for insects and its dermal toxicity ratings for man. Not all occupational incidents of employed persons are reported. This pesticide is also widely used on smaller farms that may not have employees; pesticide-realted exposures not involving employees are usually not reported. It has also become apparent through the experience of medical supervisors that parathion and mevinphos (Phosdrin) are responsible for the majority of the serious organophosphate occupational exposures in Califorina in which there is significant cholinesterase depression without the development of clinical symptoms. Althoug this is a very effective pesticide, it has to be used with great care to avoid adverse human effects.

A number of combined approaches have been or are going to be put into effect to limit the hazards of parathion usage:

1. Labeling - The labels currently required for parathion are the best in use today that specifically warn of the hazards encountered by user and give measures necessary to avoid the hazards. Conscientious adherence to the label requirements will usually, but not always, prevent excess human exposure.

2. Restricted Use Classification - Requiring permits for use of parathion has limited its use to persons more likely to use it correctly.

3. Additional Regulations on Usage - Although occasional use in accord with the label usually does not result in adverse human effects, it has been desirable to protect the frequent user of parathion from adverse health effects by medical supervision, frequent testing for cholinesterase, use of clean outer clothing daily, and other safe work practices.

4. Closed System Mixing and Loading - Even careful and qualified users have spillage of small amounts of liquid from time to time. This is a serious hazard with parathion because of the ease with which it passes through human skin. Closed system handling of liquid formulations can minimize this risk.

5. Dusty Wettable and Soluble Powders - Inhalation hazards need additional attention. A tight standard for lack of dustiness should be met or these formulations should only be sold in water soluble packages that can be put directly into the mixing tank.

6. Protection of Ground Applicators - Above 85 F it is difficult to keep the required complete body suiting on the driver of an open cab application vehicle. Since protective gear that will heat-stress the worker is dangerous, this work should not be continued above 85 F unless cooled air is provided under the suiting or a protective cab is available.

7. Field Worker Poisoning Prevention - It is possible to enter most fields for necessary work as soon as pesticide spray has dired or the dust has settled, as long as contact with treated foliage is avoided. A wait of 1 hour is all that is necessary for most pesticides. There are episodes in persons who have entered parathion-treated groves or fields and have been poisoned even though plant contact was carefully avoided. Labels should prohibit any entry for 24 hr unless the full applicator suiting is worn. Since parathion breaks down on foliage and in dry soil to the more toxic paraoxon, it is necessary to impose long reentry safety intervals on some crops and up to 45 days on citrus to protect field workers. It may be desirable to increase this to 60 days. Adverse health effects are rare when workers and employers adhere to the regulations specifying these intervals.

8. Usage Recommendations - University personnel, entomologists, and pest control advisers play key roles in determining when and where parathion will be used. Persons making recommendations should consider the use of satisfactory alternate pesticides which are available for most of the uses for which parathion is recommended.

9. Registration Status - The health and safety problems of continued use of ethyl parathion are so numerous and complex that it appears prudent to consider phasing out most of the uses of this pesticide within 5 years.

SUMMARY

There were 68 cases of human exposure reported for ethyl parathion in 1975 that involved employed persons. Existing label requirements and established regulations are stringent and difficult to follow for this particular pesticide. In the five-year period 1970 through 1975, there were 351 occupational exposures to ethyl parathion reported in California. In 1975, 921,000 pounds of ethyl parathion were applied in California and obviously large numbers of persons handled this pesticide adequately without ill effects. The potential for parathion to poison humans, however, cannot be overemphasized. The ability of this pesticide to rapidly pass through the skin is its major safety hazard. In the 1975 series of human illness cases, as in previous years, many workers claimed they were not aware they had been exposed to vapor or droplets of parathion. Stringent requirements are in effect and these are contemplated to limit the hazards. These include: label requirements, restricted use classification, regulations to protect the frequent user not adequately protected by label requirements, closed system mixing and loading, elimination of dustiness of wettable and soluble powders, protection for ground applicators when the temperature is above 85 F, adhering to reentry safety intervals, and alternate pesticides whenever feasible. The health and safety problems of ethyl parathion are so numerous and so complex that it appears prudent to consider phasing out most of the uses of this pesticide in California within 5 years.